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WHITE RIVER SHALE PROJECT

DETAILED DEVELOPMENT PLAN

FOR

OIL SHALE TRACTS Ua AND Ub

UPDATE

SEPTEMBER 1982

Prepared by:

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1.0 INTRODUCTION

On March 2, 1982, the White River Shale Oil Corporation (WROSC) received approval of its Detailed Development Plan (DDP) for development of the Ua and Ub Tracts in northeastern Utah to produce commercial quantities of upgraded shale oil. On September 1, 1982, WROSC received from the Utah Division of Oil, Gas and Mining (UDOGM) a Mining Permit for Phase I of the White River Shale Project (WRSP). A copy of the Mining Permit Application as well as all updates has been provided to the Oil Shale Office (OSO).

The approved DDP for the WRSP is the source for the majority of the information contained in the Mining Permit application. However, as mine development design has progressed, certain concepts, methods and detail expressed in the DDP have evolved and changed. The purpose of this document is to review and discuss these changes. Other areas mentioned in this update have not changed from the DDP, but are presented in this document for clarity. Accordingly, the sections of the DDP correspond to the sections in this document (e.g., Section 3.0 Description of the Proposed Action).

The WRSP as described in the DDP has not changed in goals or concept. In summary, it is divided into three integrated phases. Phase I will serve as a full scale demonstration facility designed to advance the state of the art for oil shale mining and processing. Phases II and III will be successively larger commercial scale facilities. A conventional room and pillar mine will be developed to recover a minimum of 63% of the resources contained within the primary mining zone on the tracts. Mine production (in tons per stream day) is estimated as follows:

Phase I	27,330 TPSD
Phase II	93,460 TPSD
Phase III	176,740 TPSD

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The raw shale will be processed in surface retorts and the oil produced will be upgraded on site to produce a high quality synthetic crude oil.

Planned net upgraded shale oil product volumes (in barrels per stream day) are estimated as follows:

Phase I	14,840 BPSD
Phase II	57,190 BPSD
Phase III	106,230 BPSD

1.1 Schedule

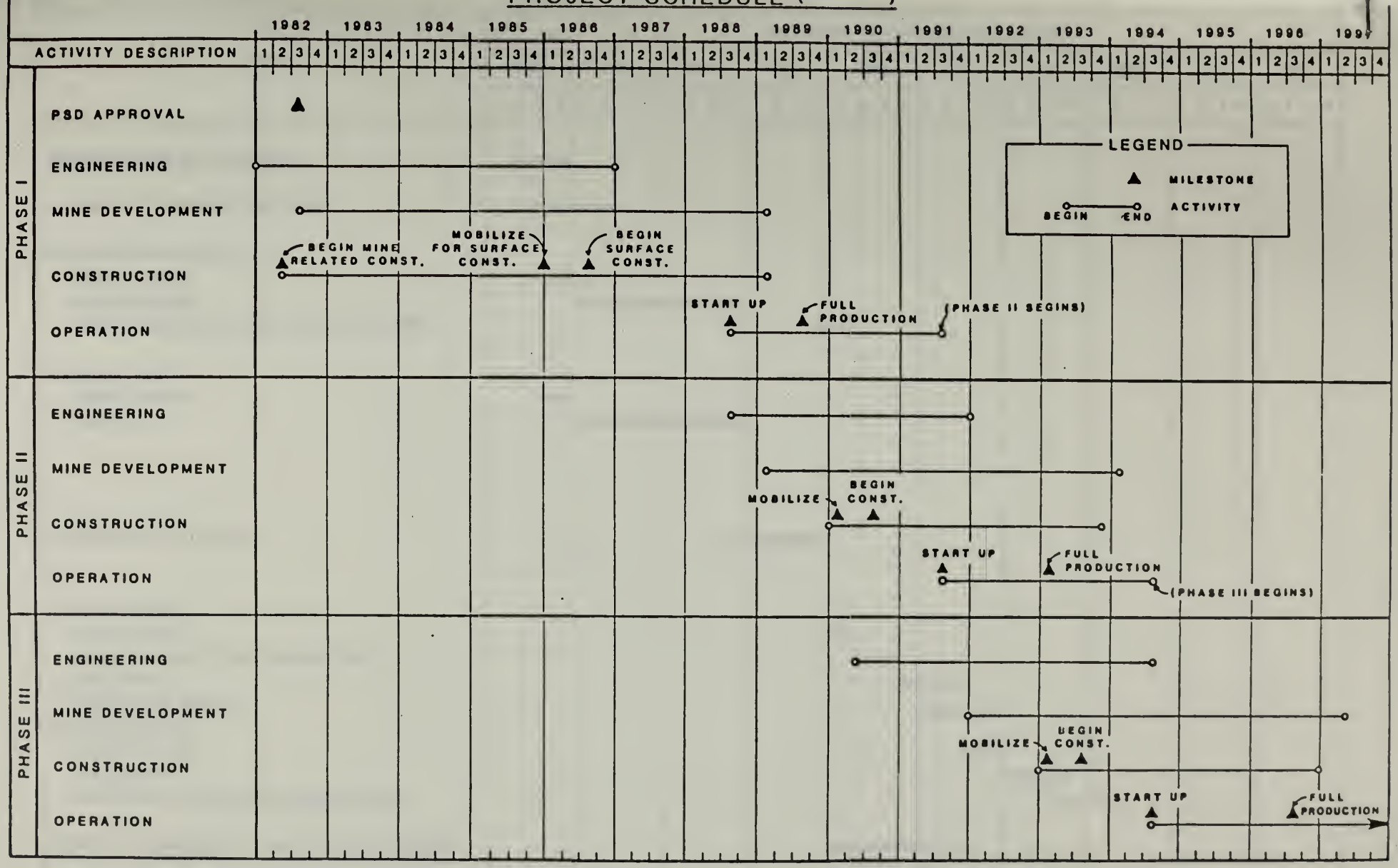
The overall White River Shale Project schedule for Phases I through III is reflected in the project schedule submitted with the Mining Permit application. This schedule is included here as Figure 1.1-1.

The schedule for Phase I development has been modified from the schedule submitted with the Mining Permit application (Table 1-1). Figure 1.1-2 of this update is a revised schedule for Phase I mine related construction. Construction of surface facilities associated with retorts and other processing facilities is not shown on a detailed schedule at this time. The detailed development schedule for near term construction is discussed in Section 3.3.1.

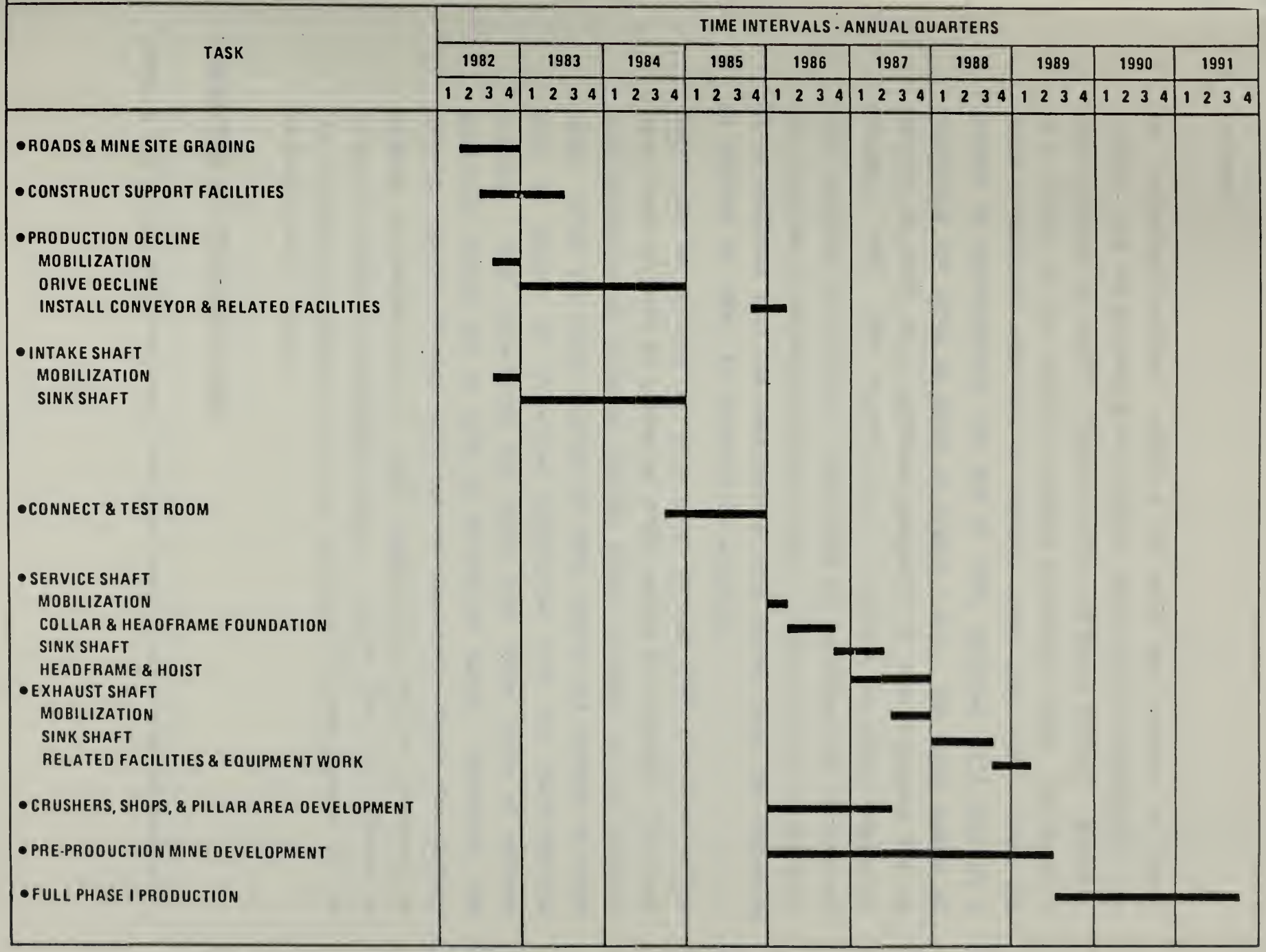
Changes in design (e.g., production decline rather than production shaft) and increasingly more accurate estimates of construction time have resulted in a number of delays which have been incorporated into the schedule. The time required for construction of the production decline and the ventilation intake shaft is just over two years. All other underground development will begin after the shaft and decline are complete.

WRSOC has delayed the construction of surface processing facilities in order to await and evaluate the design and tests of full scale retorts. Existing data is inadequate for design of facilities in support of the retorts. Mobilization for construction of Phase I surface facilities is scheduled for early 1986. This delay in construction and subsequent operations will also cause a commensurate delay in Phase II and III.

PROJECT SCHEDULE ( )



PHASE I MINE CONSTRUCTION SCHEDULE



1.2 Manpower

The estimated manpower required to build and operate the mine, retorts, and the upgrading and support facilities is essentially the same as shown in the DDP (Figure 3.20-1 and Table 3.20-1). However, as a result of the schedule changes discussed above, the peak in Phase I manpower will not be reached until late 1987. From the present to approximately the end of 1985, manpower will stay at a relatively low level as shown in Figure 1.2-1. The total number of workers on tract will increase gradually to approximately 200 by November, 1983. When construction of surface facilities begins in 1986, manpower on tract will experience the increase that is depicted as occurring in the second project year in Figure 3.20-1 of the DDP. It is believed that the remainder of this curve, once the beginning is shifted to 1986, is essentially accurate.

Due to the low manpower level on tract through 1985, the construction work force will not be housed on tract during this period. It is not cost effective to build an initial small increment of the bachelor camp. After the first quarter of 1983, nearly all workers on tract will be miners or otherwise associated with the shaft/decline sinking. Past experience has shown that these types of workers generally choose not to live in RV/trailer camps. Therefore, the present interim RV camp will not be expanded. These few workers seeking accommodations in local communities are not expected to cause an adverse socioeconomic impact. After 1986, the effects of the increase in manpower will be mitigated by development of the bachelor and RV camps.

DESCRIPTION OF THE PROJECT AREA

Section 2.0 of the DDP provides a detailed description of the project area.

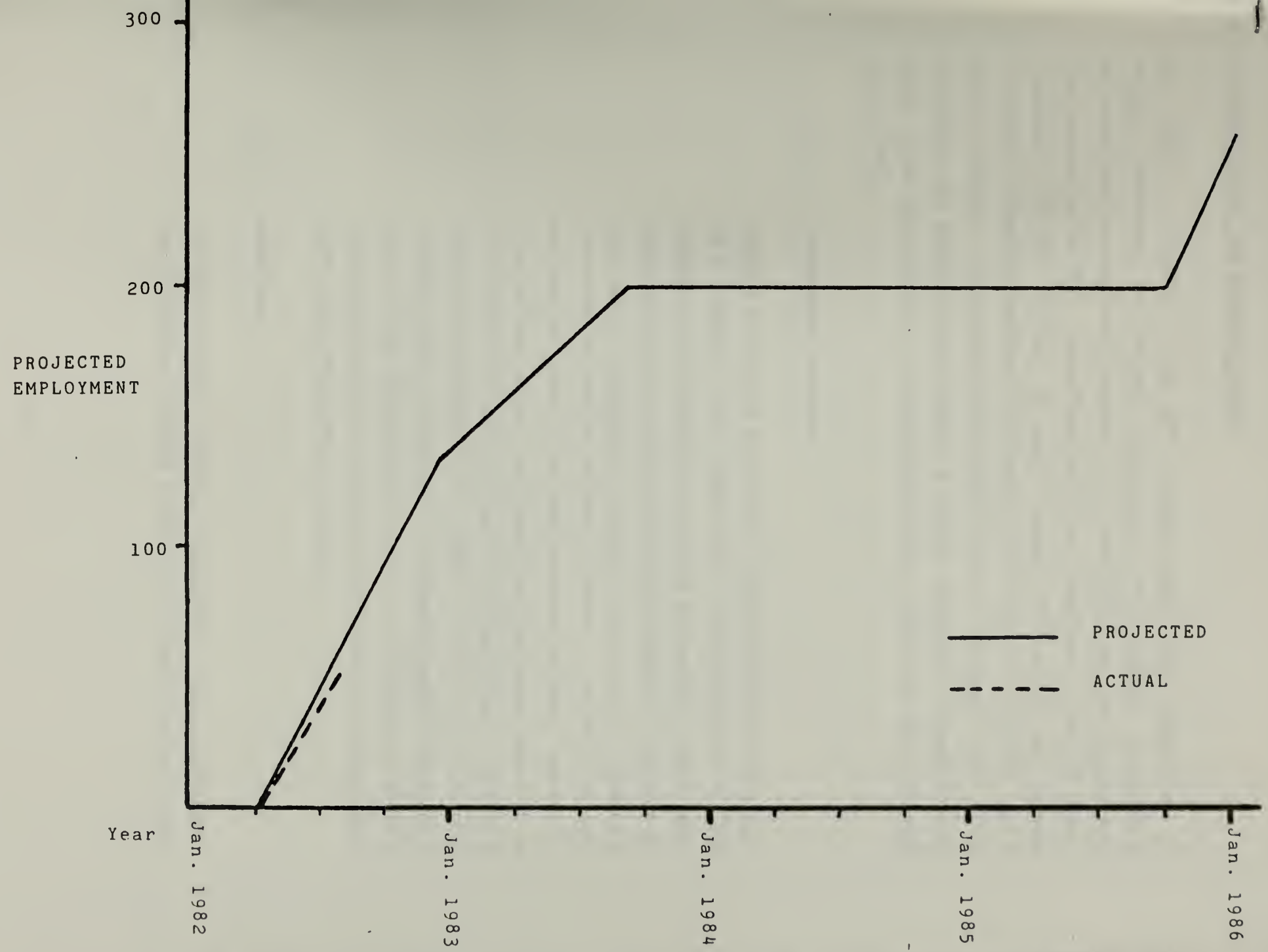


Fig. 1.2-1 PROJECTED AND ACTUAL WRSP WORK FORCE, JANUARY 1982 - DECEMBER 1985

DESCRIPTION OF THE PROPOSED ACTION

The WRSP as described in the DDP is based upon staged development of mining, processing, and related operations in three phases. The quantity of shale rock and shale oil expected from each Phase has not changed from that stated in the DDP. Supporting facilities described in the DDP remain unchanged and will consist of gas treatment for sulfur and ammonia recovery, wastewater treatment, processed shale disposal, utilities, solid waste handling, maintenance and administrative facilities, raw water treatment and potable water supply, a runoff retention dam and holding pond, crude and product oil storage tanks, and interim RV camp (through June, 1983).

3.3.1 Development Schedule

Initial activities at the mine site include the development of a temporary mine access road, site preparation for the sinking of the production decline and service shaft, site preparation at the mine service building area, grading of the topsoil stockpile area and provisions of temporary construction erosion control features. The shaft collars and decline portal, the mine service building, electrical distribution system, and runoff holding pond dam will be constructed following initial site preparation. A detailed construction schedule for Phase I near term activities (through 1985) is provided in Document Numbers SCH-00-PR-9 (Rev. 2) and SCH-00-PR-10 (Rev. 2). Additional details concerning shaft and decline construction will be provided after this subcontract is awarded.

3.3.6 Retorting

The WRSOC general retorting philosophy remains unchanged. The objectives of Phase I are still to evaluate and assess

retort technology and related mining, crushing and material handling operations and their environmental impacts. Our plans are still based on construction and operation of two surface retorts handling up to 30,000 tons per day of coarse shale and processing facilities to produce about 15,000 barrels per day of upgraded shale oil. However, WRSOC plans to utilize two Union retorts during Phase I, rather than one Superior and one Union. WRSOC has executed a License Agreement with Union which became effective on July 14, 1982. This agreement entitles WRSOC to place observers in Union's Colorado pilot plant. A final decision on The Phase I retort mix will be made based on further information on The Union and circular grate processes.

3.3.19 Permits

All federal, state, and local permits required for the construction and operation of Phase I of the WRSP are listed in Table 3.3-1.

3.4 Layout of Facilities

The overall layout of the WRSP facilities has not changed significantly from that shown in the DDP and the Mining Permit Application. Drawing D-00-CE-3 (Rev. 2) is the current plot plan for the surface mining facilities.

The most notable changes from the DDP include the minor relocation of the plant area runoff holding pond, relocation of the fine shale and coarse shale stockpiles, and use of a decline rather than a production shaft.

Table 3.3-1

PERMIT AND APPROVAL LIST

Title	Regulating Agency(a)	Regulation or Code	Minimum Processing Time
FEDERAL			
National Pollutant Discharge Elimination System	EPA	40 CFR 121-125, 133	6 months
Disposal of Hazardous Wastes	EPA	40 CFR 260-265	6 months
Spill Prevention Control and Countermeasures Plan	EPA	40 CFR 112	n/a
Detailed Development Plan	DOI, USGS, OSO	Section 10, Federal Oil Shale Leases #25918 and #26194, June 1, 1974	3-4 months
Temporary Use Permit	BLM		1 month
Rights-of-Way Permits	BLM		1-2 months
Permit to Import, Manufacture, or Deal in Explosives	DOT, BATF	27 CFR 181	1-2 months
Communications Facilities	FCC	47 CFR 80	
Endangered Spcies Clearance	OSO/USFWS	16 USC 1351	4 months
OSO Approval	OSO	Lease	1 month
MSHA Permits	MSHA	30 CFR 40-44, 48, 50, 57	2 weeks
Nonsegregated Facilities	DOL	41 CFR 60	1-2 months

Table 3.3-1

Title	Regulating Agency (a)	Regulation or Code	Minimum Processing Time
UTAH STATE			
Permit for Discharge of Wastewater into State Waters	Bureau of Water Pollution Control, UDOH	UCA 73-14-5	1 month
Construction Permits for Sanitary and Industrial Waste Disposal	Bureau of Water Pollution Control, UDOH	UCA 73-14-5	1 month
Approval of Plans and Specifications for Water Facilities	Bureau of Public Water Supplies, UDOH	UCA 26-36-4	1 month
Approval of Disposal of Solid Wastes	Bureau of Solid Waste, UDOH	UCA 26-15-5 (5) (c)	2 weeks
Disposal of Hazardous Wastes	Bureau of Solid Waste, UDOH	UCA 26-37-15	9 months
Plan Approval for Food Service	Bureau of Sanitation, UDOH	UCA-26-15-5	2 weeks
Plan Approval for Labor Camp Sanitation	Bureau of Sanitation, UDOH	UCA 26-15-5	2 weeks
Application to Appropriate Water	UDWR	UCA 73-3-1	6 months
Approval Letter - Dam Construction	UDWR	UCA 73-5-5	1 month
Mining Permit (includes Notice of Intent to Mine and Reclamation Plan)	UDOGM	Mined Land Regs., Rules M-3 and M-10	2-4 months

Table 3.3-1

Title	Regulating Agency (a)	Regulation or Code	Minimum Processing Time
UTAH STATE - Continued			
Prevention of Significant Deterioration	UBAQ	UCA 26-21-9	6-12 months
Permit to Operate Overweight or Oversize Vehicles on State Highways	Highway Patrol, UDOT	UCA 27-12	1 day
Antiquities Section Permit	Division of State History	UCA 63-11-2	1 week
Historic and Cultural Review	Division of State History	UCA 63-28-32-38	1-2 months
Authorization to Drill Exploratory Well	UDOGM	Rule C-4	1 month
Permit to Drill (Owner)	UDWR	UCA 73-3-26	1 month
Ground Water Well Report	UDWR	UCA 73-3-22	N/A
Mine Core Abandonment Report	UDOGM	Rule C-12	N/A
Socioeconomics (SB-170)	UDCED		3 months
Permit to Drill Well (Driller)	UDWR	UCA 73-3-25	1 month

Table 3.3-1

Title	Regulating Agency (a)	Regulation or Code	Minimum Processing Time
UINTAH COUNTY			
Building Permit	County Planning Commission		
Construction Camp Conditional Use Permit	County Planning Commission		1-2 months

(a) Acronyms:

BATF - Bureau of Alcohol, Tobacco and Firearms
BLM - Bureau of Land Management
DOI - Department of the Interior
DOL - Department of Labor
DOT - Department of Transportation
EPA - Environmental Protection Agency
FCC - Federal Communications Commission
MSHA - Mine Safety and Health Administration
OSO - Oil Shale Office
UBAQ - Utah Bureau of Air Quality
UCA - Utah Code, Annotated
UDCED - Utah Division of Community and Economic Development
UDOH - Utah State Department of Health
UDOGM - Utah Division of Oil Gas Mining
UDOT - Utah State Department of Transportation
UDWR - Utah Division of Water Rights
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey

The plant area runoff holding pond, located in the northeast corner of Tract Ua, was moved approximately 1000 feet down drainage from the location shown in Figure 3.4-1 of the DDP. The new location will allow a smaller and less expensive dam to be built. A portion of the dam and pond will extend off tract onto federal land administered by the Bureau of Land Management (BLM). A Right-of-Way Permit request has been submitted to the BLM. Additional permits for the dam and pond include an National Pollution Discharge Elimination System (NPDES) Permit, a Gravel Borrow Permit, a Clay Borrow Permit, Water Appropriation - Runoff Permit, Pond and Dam Plan and a Construction Permit. Construction will not commence until the necessary permits have been acquired. A site geotechnical study has been completed (WRSP Geotechnical Report by Woodward - Clyde Consultants, June 1982) and design of the dam is in progress.

The arrangement of Phase I mine shafts has been changed from that shown in the DDP and a decline portal has been added. These changes are described in Section 3.6.

The alluvial test wells have been drilled and tested in the same location as indicated in the DDP. A decision has been made to locate the production water wells in that area.

A solid waste disposal site has been selected within the Phase I spent shale disposal area. Minor changes in building configuration and road alignments and routes have been made from that indicated in the DDP to accomodate the changes in design; however, all such changes will occur within the area approved by the OSO on March 2, 1982.

3.5 Mining

The WRSP has altered its plans to develop and mine 27,230 TPSD of oil shale during Phase I. A production decline will be excavated rather than the vertical production shaft discussed in the DDP (the intake ventilation shaft will be located where the original production shaft was sited). The WRSP will sink a service shaft and an intake ventilation shaft in the same area as shown on Figure 3.4-2 of the DDP. The location of the Phase I exhaust shaft has also been changed to accommodate the mine layout. Drawing E-92-GA-1 provides isometric details for the underground mine general arrangement.

A preliminary year by year development of the Phase I mine layout developed at the request of the Utah Division of Oil, Gas and Mining is shown in Fig. E-817-UM-GI. This figure is a more detailed mine plan than Figure 3.5-4 of the DDP. Configuration of the underground layout of the mine may be altered during final design as mechanical properties of the mining zone, logistics, ventilation and materials handling information is further refined. The shaft pillar area will be excavated while the drift to the exhaust shaft is being developed. Following completion of the shaft pillar area, development of room and pillar mining panels will commence.

As shown in flow diagram Drawing D-92-FS-1 the primary crusher will be located in a chamber below the dumping bin and above a bin to receive the primary crushed shale. The primary crusher chamber is configured so that the crusher can be removed at a later date when mined material is transported to the chamber by conveyors rather than by trucks. A conveyor belt will receive the primary crushed rock from the storage bin and deliver the crushed rock to the secondary crusher area. The secondary crusher is located above a 1000 ton storage bin.

The secondary crushed rock will be extracted from the storage bin by means of feeders and transferred onto a conveyor belt. The conveyor belt will travel horizontally below the feeders and then transition to the production decline to raise the rock to the surface. An intermediate transfer station will be provided at the dogleg in the decline.

The lube and fuel station is located in a dedicated excavation set into the rib (wall) of a drift which will exhaust directly to the exhaust shaft. The fuel and lube storage excavation is equipped with cylindrical tanks for diesel fuel and three grades of lube oil. The maintenance shop is laid out in a single drift which parallels a main airway. It is accessed at each end by a cross-cut from the main airway and by four (4) intermediate cross-cuts. At the air intake end of the workshops there is a drainage sump to collect wash water from the repair bays. In the main air intake drift ahead of the shop entrance is an equipment wash platform. A detailed underground mining general arrangement is shown in Drawing D-92-GA-5 (Rev. 0).

The primary ventilation for the mine is provided by surface fans located at the exhaust shaft. The crushing and materials handling facilities, the maintenance shops, and the lube and fuel oil facilities are ventilated by separate splits of fresh air which are returned directly to the exhaust shaft. Approximately 3,108,000 CFM of air will be ventilated through the exhaust fan. A decline exhaust is also provided to ventilate the decline at a maximum rate of 530,000 CFM.

3.6 Decline and Shaft

The DDP indicates that four vertical shafts will be required (a production shaft, service shaft, and air intake and an air exhaust shaft). Current design includes a service shaft, an intake ventilation shaft, an exhaust shaft, and the portal opening to a production decline. The location of these openings has not changed from the Mining Permit Application.

The production decline and the intake ventilation shaft will be constructed at approximately the same time. Enclosed with this document is the set of drawings which are part of the shaft/decline bid package. The decline will consist of a portal, a transfer station, a transfer station by-pass, a decline access ramp, decline roadway and a conveyor system. The decline will be driven to the northeast (generally toward the centroid of Tract Ub) at approximately N68° 88' 48" E. The decline will be equipped with an exhaust ventilation raise approximately 200 feet from the portal opening.

At about one-half its total length (at elevation 4941 feet) the decline will change directions (dog-leg) such that the opening at the mine level will be in the general vicinity of the service and intake shafts. At the point where the production decline reverses directions, it will not have intercepted the Bird's Nest Aquifer. The decline will be equipped with a conveyor system to move crushed raw shale to the surface during Phase I operation. The upper leg of the decline will be sized to hold both the Phase I and Phase II conveyor systems. (Prior to Phase II operation, the upper leg of the decline will be continued on toward the northeast to intercept the mining zone near the Tract Ub centroid. This northeasterly oriented decline is described in the DDP).

The top leg of the decline will be inclined approximately 13° while the bottom leg will be inclined approximately 15°. The cross section of the top leg of the decline will be 12 feet by 28 feet and the bottom leg cross section will be 12 feet by 18 feet. The decline will be approximately 5640 feet long. The top leg will be 2042 feet, dog leg 360 feet, bottom leg 2488 feet and the bottom turn 750 feet (connecting the decline to the air intake shaft).

A 30 foot diameter air intake shaft will be constructed in the same time frame as the decline. The air intake shaft will be approximately 1054 feet deep. A chippy hoist will be installed in this shaft.

A 30 foot diameter vertical service shaft will be sunk following completion of the decline and air intake shaft. The service shaft will be equipped with a lift and a hoisting system will be installed in a headframe. The shaft headframe will be approximately 160 feet high.

A 30 foot diameter vertical exhaust shaft will be sunk for the Phase I mine following completion of the air intake and service shafts and the production decline.

3.6.1 Gassy Mine

The "Mahogany Zone" on Tracts Ua and Ub is believed to be gassy with at least methane and hydrogen sulfide gasses. During shaft and decline excavation drill holes of 1-3/8 inch minimum diameter will be drilled to test for the presence of water and gases. The test hole will be drilled so that the hole remains within 5 feet of the neat line excavation to be tested. The test hole will be kept a minimum of 25 feet in advance of the work, gas will be measured ~~at the opening of the test hole.~~ The mine will be deemed gassy when MSHA classifies the mine as gassy based on a concentration of 0.25% or more of flammable gas detected. Regardless of gas concentration the workings will be considered gassy from 200 feet above the mining zone to completion. Schedule 31 certified mobile equipment will be used when a concentration of 0.25% of flammable gas is detected or when the excavation reaches elevation 4661 feet.

3.6.2 Construction Execution Plan

Specific construction execution plans for the decline/shaft will be developed by the construction subcontractor. When

a subcontractor for the decline/shaft sinking has been chosen (about October 5, 1982), details of the execution plan will be transmitted to the OSO.

3.10 Processed Shale Disposal

The processed oil shale will be disposed of in a portion of Southam Canyon as described in the DDP. The size of the Phase I disposal area has been increased to keep the final elevation of the pile below the ridgeline of upper Southam Canyon. Since knowledge of the physical properties (stability, compactability, etc.) of processed shale obtained from Tracts Ua and Ub is limited, a conservative plan was adopted to allocate a larger area for Phase I disposal. If the Phase I disposal area proves to be more than sufficient for disposal of Phase I processed shale, shale from Phase II production will also be deposited there prior to use of the remaining Phase II processed shale disposal area as indicated in the DDP.

As previously discussed with the OSO, a 25-acre test area (See Fig. 1-8, Mining Permit Application) will be constructed with the initial production of processed shale. The purpose of the Phase I processed shale research plot is to provide a site for both engineering and reclamation studies. Each of the studies will be interactive. The plot is needed in Phase I in order to extend small-scale plot, laboratory, and greenhouse studies into near commercial scale. The Phase I processed shale disposal pile will be constructed in a side canyon to Southam Canyon south of the mine shaft area. The processed shale research plot will be established in this area but will be separated from the main Phase I pile to allow for long-term, uninterrupted research efforts. The experimental plot will have a depth sufficient to allow realistic compaction and hydrological studies and testing of our reclamation plans. The Phase I processed shale runoff dam and reservoir described in the DDP will be constructed down-gradient of the pile to collect any surface runoff or leachate from the pile. A final plan for revegetation of the processed shale pile will be developed prior to the retorting of the shale.

3.11 Solid Waste Disposal

A 2 acre solid waste landfill site for Phase I has been designated in the eastern portion of the Phase I processed shale disposal area (See Drawing D-00-CE-3). All non-hazardous solid wastes will be landfilled at this site. The solid waste landfill site is designed to accommodate approximately 46,000 cu. yds, consisting of 21,500 cu. yds. of refuse, 15,500 cu. yds. of construction debris, and 9,000 cu. yds. of soil cover. The lifetime of the landfill site is expected to be approximately 6 years (1983 to 1988).

The feasibility of disposing of non-hazardous solid waste directly with processed shale, as described in the DDP, will be verified prior to initiating this practice. The landfill will be utilized exclusively for non-hazardous solid waste prior to the verification of this practice. Hazardous wastes generated during the construction period will be transported to an approved off-tract hazardous waste disposal site.

3.15 Wastewater Management Plan

The Bird's Nest Aquifer is known to contain water. During the decline and shaft penetration through the aquifer, water will be sealed off by means of a grout curtain. Construction specifications require that the chemical grout shall be capable of penetrating an environment with a permeability of 0.0003 ft/sec under a pressure of 100 psi. All holes that will accept water will be injected with a seal of 1:1 (cement: water) grout.

It has been estimated that water flows as high as 100 gallons per minute (gpm) can be expected when the shaft and decline penetrate through the Birds Nest Aquifer. All of this water will be placed in the plant area runoff retention pond.

The mine water will be contained in a reservoir behind a clay core dam about 50 feet high from grade and 600 feet long. The dam is being designed to contain a flood with 100 year recurrence period. The dam site is covered with up to 17 feet of alluvium and is underlain by 10 to 30 feet of fractured and weathered sandstone or marlstone. The soil and rock in the upper 60 feet of the ground surface is relatively permeable. A minimum 20 foot wide cut-off trench replaced by compacted clay within the fractured bedrock will be provided to control seepage through the fractured bedrock. The seepage through the dam is to be controlled with an impermeable clay core. Grout curtains will be provided to control seepage under the dam and grouting will be carried into the abutments of the dam to control seepage around the dam (See Figure 3.15.1). The pond will not be lined.

The bedrock in the dam and retention pond area consists predominantly of sandstones with minor interbeds of marlstone and siltstone. The sandstones range from poorly to moderately well cemented, are generally medium hard to very hard, fine to medium grained, and range from clean to silty. The rock ranges from thick-bedded and nearly massive with widely-spaced joints and poorly defined bedding, to thin to medium bedded with moderately spaced joints and well defined bedding. The marlstones and siltstones are generally hard to very hard, silty and locally sandy, and thinly bedded. They are fresh to moderately weathered and locally highly weathered, and widely jointed to locally closely fractured. No compaction folding is evident in the dam and retention pond area.

Small quantities of water may seep through the clay core. A gunite lined collection pond will be provided at the down stream toe of the dam to collect any possible seepage. Most of the water collected in the pond will be evaporated and the remaining water will be pumped back into the reservoir.

The wastewater from the interim RV Camp will be disposed of in a holding tank and emptied periodically by a contracted scavenger service. The scavenger has permission to dispose of sewage in the Vernal sewage system. Portable sanitary facilities will be provided on site during construction activities. A wastewater treatment plant will be constructed to serve the mine area and will include sewage collection, treatment and effluent disposal. The system at the mine site will be capable of handling sewage generated during the first increment mine development. Sewer systems will be designed with sufficient capacity for future expansion. Sewage will be treated to a quality meeting the Utah advanced treatment effluent requirements. A treatment plant, complete with equalization, primary clarification, biological treatment, tertiary filtration, and chlorination, will be provided at the mine site. Details of this treatment system are contained in the construction permit which will be submitted to the Utah Bureau of Water Pollution Control.

PLANNED ENVIRONMENTAL PROTECTION PROCEDURES

4.1 Air Pollution

The White River Shale Project was issued a feasibility PSD approval order from the Utah Air Conservation Committee on August 4, 1982. This approval allowed WRSP to proceed with construction and reserved the PSD increments requested in the PSD permit application. Emission control requirements for point sources listed in the PSD application will be approved individually based on a Best Available Control Technology (BACT) evaluation as detailed plans and specifications become available.

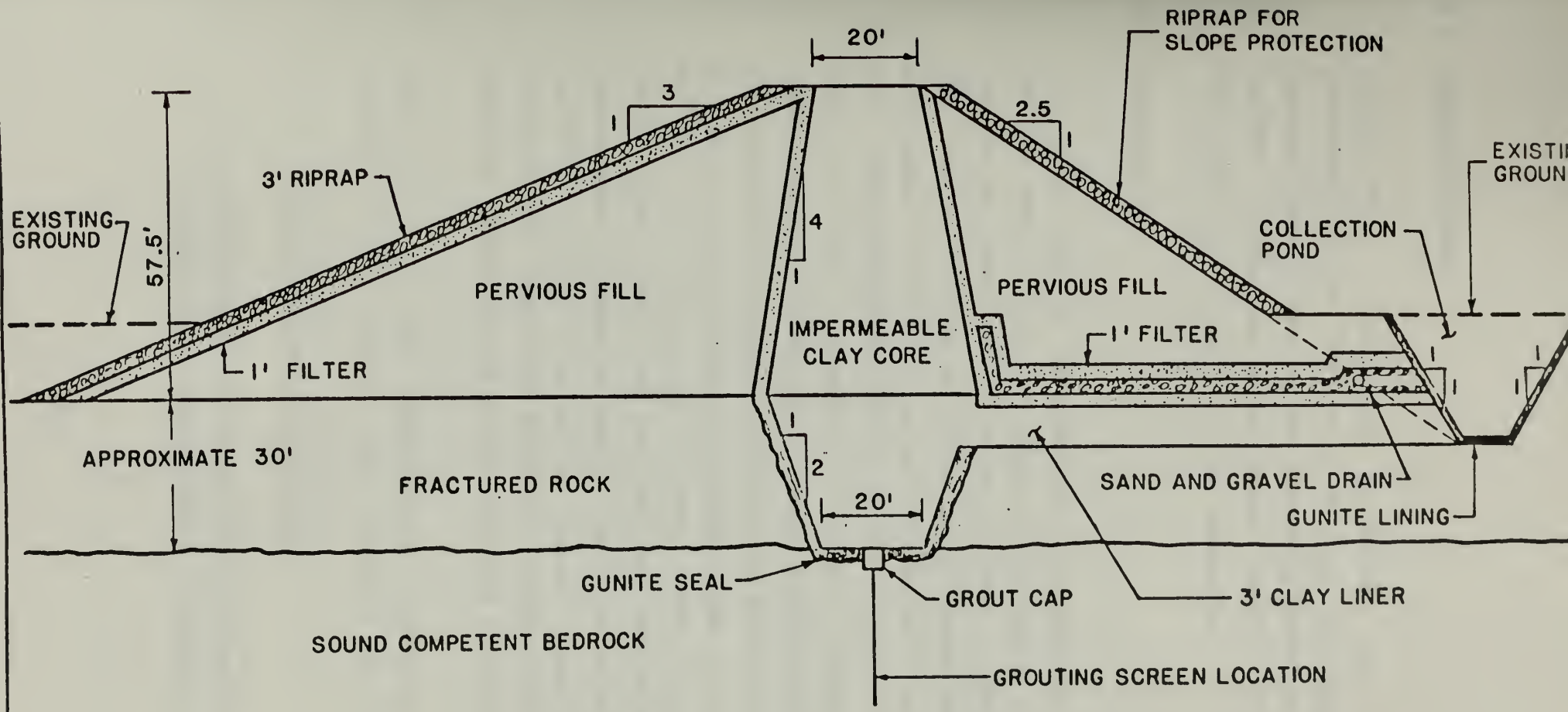


FIGURE 3.15-1 RUNOFF RETENTION DAM

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4.3 Hazardous Wastes

During Phase I construction activities, any hazardous wastes generated will be transported off-site for disposal in a state approved disposal site, rather than being stored on site as stated in the DDP. A hazardous waste disposal facility will be developed on tract prior to the start of plant operations.

4.6 Revegetation

The current plan for revegetation of construction disturbed areas has been developed in more detail in the Mining Permit Application than in the basic plan which is discussed in Section 4.6.1 of the DDP. Section 4.6.2 of the DDP reflects current knowledge and plans with respect to revegetation and reclamation of the processed shale pile. The approach outlined in the DDP emphasizes conservation and reuse of topsoil, shredding of suitable existing vegetation to create mulch, and selection of native species which are adapted to the rigorous environmental conditions and which also will contribute to control of soil erosion and provide forage for animals. Based on the DDP and on discussions of recent research with Dr. C. McKell (Native Plants, Inc.) WRSP has developed detailed criteria for the revegetation of disturbed lands. The criteria are consistent with the DDP approach to revegetation; however, a number of changes and additions have been made which will increase the probability of achieving successful native species growth on disturbed areas.

Tables 4.6.1 and 4.6.2 summarize and compare the implementation measures for each area as a final review of the revegetation plan.

a. Topsoil Salvage and Stockpile

During Phase I mine development activities (until 1986), it is expected that approximately 110 acres will be disturbed.

REVEGETATION PLANS SUMMARY BY SUB-AREA

TABLE 4.6-1

TERIA	GENERAL DISTURBED AREAS IMPLEMENTATION	TEMPORARY MINE ACCESS ROAD IMPLEMENTATION	PROCESSED SHALE AREA IMPLEMENTATION
formed by	Private contractor	Private contractor	Private contractor or WRSP
atment	Chemical stabilizers to reduce wind erosion on topsoil stockpiles.	Fertilizer	Chemical stabilizers to reduce erosion on shale slopes.
ation	Site specific; as necessary based on soils test results.	Site specific; as necessary based on soils test results	Nitrogen and phosphorus in soil trenches before planting. Nitrogen fertilizer to shale slopes. Processed sewage and water treatment sludge as a soil amendment and conditioner in the trenches.
	N/A	Straw mulch or hydromulch mix of annual native plant seeds with less than 1% weedy species @2,000 lbs/acre.	N/A
on	Not required, except for periodic watering of seeded-topsoil stockpiles and landscaped areas.	Water trucks	Drip system using reclaimed process water, if required.
l preparation	Disk harrows to till compacted slopes, topsoil respread to smooth, firm surface free of large debris and woody vegetation.	Topsoil respread to smooth, firm, clear surface. Following mulch application, area will be anchored by rolling and crimping.	Shale slopes surface will be crushed and compacted. Trenches will be dug and filled with excavated topsoil. After planting in trenches, slopes may be enhanced by roughening.
program	First fall after construction. Seeding preceeds transplanting. Drill seeding @15 lb/acre; broadcast @30 lbs/acre. Transplanting @1750 plants/acre.	Areas subject to erosion will be temporarily stabilized with a seed/mulch mixture. Final revegetation per general disturbed area plan.	Container-grown or bare-root plants will be transplanted in soil trenches in the spring.
method	Drill, or broadcast followed by light raking.	Spread by power mulch equipment.	Seeds from plants in soil trenches will colonize shale slopes gradually.
mix	See Table 2-3.	See Table 2-3.	See Table 2-3.
ion protection	Fencing, repellants, and interseeding of adjacent undisturbed area.	Fencing, repellants, and interseeding of adjacent undisturbed areas.	Livestock fencing, electric if necessary, big game repellants, sound systems, deer fencing, rodent controls, repellants or rodenticides.
ion	Periodic - foraging wildlife impacts.	Periodic - foraging wildlife impacts.	Periodic - foraging wildlife impacts.
ance/Repair	Damaged areas will be revegetated and covered with biodegradeable fabric as soon as possible.	Stabilized areas will be anchored and covered with biodegradeable fabric and repaired as soon as possible.	Damaged areas will be repaired as soon as possible.
esting	Nutrient level, salinity, pH	Nutrient level, salinity, pH	Nutrient level, salinity, pH

In each case, shredded vegetative matter will be left in place for use as a topsoil amendment, if feasible.

6/21/82

REVEGETATION PLANS SPECIES MIX BY SUB-AREA

General Disturbed Areas

Seeding

Shrubs: The seed mixture will consist of at least 8 shrubs, 2 grasses 1 annual species so that 15 lbs/acre (30 lbs/acre for broadcast seeding) is applied.

			Application Rate/Acre
Four-wing Saltbush	Atriplex	canescens	2.0 lbs
Shadscala	Atriplex	confertifolia	2.0
Mat Saltbush	Atriplex	corrugata	2.0
Cuneata Saltbush	Atriplex	cuneata	1.5
Gardner Saltbush	Atriplex	gardneri	1.5
Greasewood	Sarcobatus	vermiculatus	2.0
Winterfat	Ceratoides	lanata	2.0
Hopsage	Grayia	brandegei	2.0
Spiny Hopsage	Grayia	spinosa	2.0
Summer Cypress	Kochia	americana	1.0
Prostrate Kochia	Kochia	prostrata	1.0
Rabbitbrush	Chrysothamnus	greenii	1.5
Rabbitbrush	Chrysothamnus	nauseousus	1.5
Big Sagebrush	Artemisia	tridentata	2.0
Black Sagebrush	Artemisia	nova	2.0

Grasses:

Western Wheatgrass	Agropyron	smithii	2.5
Indian Ricegrass	Oryzopsis	hymenoidea	2.5

Annuals:

Cryptantha	Cryptantha	sp.	1.0

Transplanting:

At least 10 species which approximate adjacent undisturbed areas will be planted randomly, not grouped by species.

Four-wing Saltbush	Atriplex	canescens	1750 plants
Shadscala	Atriplex	confertifolia	5 ft.apart
Mat Saltbush	Atriplex	corrugata	
Cuneata Saltbush	Atriplex	cuneata	
Gardner Saltbush	Atriplex	gardneri	
Greasewood	Sarcobatus	vermiculatus	
Winterfat	Ceratoides	lanata	
Hopsage	Grayia	brandegei	
Spiny Hopsage	Grayia	spinosa	
Summer Cypress	Kochia	americana	
Prostrate Kochia	Kochia	prostrata	
Rabbitbrush	Chrysothamnus	greenii	
Rabbitbrush	Chrysothamnus	nauseousus	
Big Sagebrush	Artemisia	tridentata	
Black Sagebrush	Artemisia	nova	
Cicer Milkvetch*	Astragalus	cicer	

Temporary Mine Access Road

Seeding

Straw hydromulch of annuals: 2000 lbs

Indian Ricegrass	Oryzopis	hymenaodea	
Russian Wildrye	Elymus	junceus	
Western Wheatgrass	Agropyron	smithii	
Cunate Saltbush	Atriplex	cuneata	
Globemallow	Sphaeralceae	coccinea	
Utah Sweet Vetch	Hedysarum	boreala	utahensis
Beard tongue	Penstemon	sp.	

To contain less than 1% weedy species.

The mulch mix will also include fertilizer to be determined on a site specific basis.

Processed Shale Area

Seeding

Gradually, seeds from plants in the soil trenches, with western wheatgrass Agropyron smithii likely the first, will colonize the shale slopes.

The slopes will also be invaded by weedy species:

Halogeston	Halogeton	glomeratus
Tumblewead	Salsola	iberica

To reduce the amount of weedy species, the slopes may be intentionally seeded with western wheatgrass. 2.5 lbs

Transplanting

Plants will be selected from the following salt tolerant species:

			Application Rate/Acre
Fourwing Saltbush	Atriplex	canescens	1750 plants
Shadscale	Atriplex	confertifolia	5 ft.apart
Mat Saltbush	Atriplex	corrugata	
Cuneata Saltbush	Atriplex	cuneata	
Garner Saltbush	Atriplex	gardneri	
Greasewood	Sarcobatus	vermiculatus	
Hopsage	Grayia	brandegei	
Hopsage	Grayia	spinosa	
Summer Cypress	Kochia	americana	
Prostrate Kochia	Kochia	prostrata	
Indian Ricegrass	Oryzopsis	hymenoidea	
Russian Wildrye	Elymus	junceus	
Western Wheatgrass	Agropyron	smithii	

TABLE 4.6-2

With topsoil depths ranging from 0 to 3.7 feet, the volume of topsoil to be stored in long-term stock piles should be approximately 165,000 cubic yards. Some topsoil will be stored temporarily adjacent to the area from which it was removed, in anticipation of revegetation within six months. WRSP has prepared a detailed Topsoil Management Plan, which has been approved by The Utah Division of Oil, Gas and Mining. The objective of this plan is to ensure, as far as is practicable, that all topsoil which is recoverable from land to be disturbed is salvaged and stockpiled for later use in revegetation. Table 4.6-3 indicates the types and estimated quantities of recoverable topsoil in each facility area as well as planned storage locations for the topsoil. Table 4.6-4 contains estimated quantities of topsoil required for revegetation at each facility area.

Following clearing and grubbing procedures, vegetation will be track rolled and ground into the soil. Topsoil will be stripped from the surface of the site to whatever depths are practicable. Topsoil storage piles will be located away from other soil material stockpiles. The topsoil stockpiles will have a concave upper surface or will be otherwise contoured to prevent erosion. The final configuration of the topsoil stockpiles will be determined by the quantity of material to be stored, the terrain of the storage site, and the length of time topsoil will remain in each stockile area prior to utilizing the soil in revegetation programs.

b. Seeding and Transplanting Program

General Disturbed Areas: (the land immediately surrounding the mine shafts and all surface mining facilities,

Mining Area								
Mine Service Building	0	1700	5800	0	0	7500	6000	
Shaft Area (incl. Admin. Bldg., etc.)	0	1100	3300	0	0	4400	3520	
Decline Area	0	2200	0	0	0	2200	1760	
Exhaust Fan Area	0	0	350	0	0	350	280	
Topsoil Stockpile Area	0	0	2700	0	0	2700	2160	
Lube & Fuel Area	0	0	3400	0	0	3400	2720	Construction Topsoil Stockpile Area (near Service Building)
Substation Area	0	0	1600	0	0	1600	1280	
Sewage Treatment Plant & Effluent Holding Pond	0	0	270	0	0	270	216	
Water Treatment Facility	0	0	760	0	0	760	608	
Mine Roads	0	13,100	2200	0	0	15,300	12,240	
Stockpile Area (Decline/Shaft)	0	550	1300	0	0	1850	1480	
Solid Waste Landfill & Road	0	0	4700	0	0	4700	3760	Local Short-Term Topsoil Stockpile
Runoff Retention Dam	115,000	0	1200	0	0	116,200	92,960	Construction Topsoil Stockpile Area (near Runoff Retention Dam)
Bachelor Camp	0	0	3600	16,500	0	20,100	16,080	Local Short-Term Topsoil Stockpile
Mine Access Road	0	33,600	230	0	0	33,830	27,064	Local Short-Term Topsoil Stockpile
Road to Dam	0	13,800	0	0	0	13,800	11,040	Local Short-Term Topsoil Stockpile
Road to Water Well	0	14,700	5100	0	3800	23,600	18,880	Local Short-Term Topsoil Stockpile
TOTAL	115,000	80,750	36,510	16,500	3800	252,560	202,048	

4.6-4 QUANTITIES OF TOPSOIL REQUIRED FOR A REVEGETATION

Facility	Topsoil Fill Needed for Revegetation (yd^3)	Excess/Deficit of Topsoil (yd^3)
ning Area		
Mine Service Building	400	+5600
Shaft Area	5500	-1980
Decline Area	375*	+1385
Exhaust Fan Area	175*	+105
Topsoil Stockpile Area	No topsoil fill required	---
Lube and Fuel Area	200	+2520
Substation Area	275*	+1005
Sewage Treatment Plant and Effluent Holding Pond	350*	-134
Water Treatment Facility	300	+308
Mine Roads	5700	+6540
Stockpile Areas	9000*	-7520
Solid Waste Landfill and Road	No topsoil Fill Required**	---
noff Retention Dam	3000*	+89,960
chelor Camp	500	+15,580
ne Access Road	1500	+25,564
ad to Dam	2300	+8740
ad to Water Well	1100	+17,780
TOTAL	30,675	+165,453***

Estimate Only - (based on the perimeter of the facility and a 10-ft. fill around facility).

*Topsoil recovered from this area will be used to cover wastes in the landfill. The solid waste landfill and road will eventually be entirely covered with spent shale.

**Topsoil Total is only an estimate; actual stockpiled topsoil may be significantly different depending on actual site condition and use.

construction camps and wastewater retention ponds). All seeding and transplanting operations will be done in the first fall, mid-October through mid-December, following completion of construction activities in the area to be revegetated. Seeding will precede transplanting. In each case, the species mix for a particular site will be ecologically compatible with the adjacent undisturbed area.

To ensure adequate cover and density, the seed mix will be applied at a rate of 15 pounds pure live seed (PLS) per acre for drill seeding and 30 pounds PLS per acre for broadcast seeding.

Nursery-grown container plants will be transplanted when the ground is moist, five feet apart at a rate of 1750 plants per acre. Each plant mix will be site specific and will consist of at least 10 species planted randomly and not grouped by species in order to afford continuity with adjacent undisturbed areas. Specifically these plants will be seedlings grown in a container designed to prevent root spiraling.

Temporary Stabilization: Temporary stabilization procedures (mulch application) will be used to prevent erosion in areas of relatively short life such as temporary road and buildings. Areas to be temporarily revegetated will be seeded with a straw mulch mixture of plant species and fertilizer. The mulch will contain less than 1 percent weedy species and will be applied at a rate of 1 ton per acre.

A straw mulch mixture including fertilizer (as needed) and seed of the following species will be utilized:

		Application Rate
Indian Ricegrass	Oryzopis hymenoides	3 lb/acre
Russian Wildrye	Elymus junceus	3
Western Wheatgrass	Agropyron smithii	3
Cuneate Salt Bush	Atriplex cuneata	2
Globemallow	Sphaeralceae coccinea	1
Utah Sweet Vetch	Hedysarum boreale uthahensis	2
Bear Tongue	Penstemon sp.	1
		15 lb/acre

Processed Shale Area:

The description of the transplanting program for the processed shale area is provided in Section 4.6.2.5 of the DDP. In an effort to reduce the quantities of topsoil required for this program, topsoil will be placed in v-shaped furrows rather than rectangular trenches for the transplanting program. The entire vegetation and transplanting program for the processed shale area will be continually updated as new information is developed by the ongoing research being conducted by Dr. C. McKell at Anvil Points, Colorado, and by the future research on tract.

c. Seeding/Transplanting Program

General Disturbed Areas: Drill seeding will be used in all areas where the seeding equipment can operate safely. Seed will be drilled to a depth of 0.5 - 0.75 inches in rows 6-8

inches apart. For terrain that is inaccessible to drills, such as steep slopes, broadcast seeding will be used followed by light raking or chaining to ensure even distribution of the seed.

Temporary Stabilization: Application of the mulch/seed mixture will be accomplished by hydromulching or equivalent techniques.

Processed Shale Area: Description of the seeding/transplanting method for the processed shale area is detailed in Section 4.6.2.5 of the DDP.

d. Soil Treatment

General Disturbed Areas: Soil treatments will generally not be required, with the exception of the application of biodegradeable stabilizers to topsoil stockpiles that are susceptible to wind erosion. Fertilizer will be used on a site specific basis. Container plants for transplanting may be innoculated with mycorrhizal fungi and, for legumes only, nitrogen-fixing bacteria prior to delivery to the site.

Temporary Stabilization: Fertilization will be included in the temporary erosion control measures. Depending upon the requirements and need of a particular site, fertilizer will be incorporated into the straw mulch used to seed critical areas.

Processed Shale Area: A description of the soil treatment for the processed shale area is provided in Section 4.6.2.5 of the DDP.

e. Vegetation Protection, Maintenance and Repair

General Disturbed Areas: Areas damaged by erosion, gullying or wildlife foraging will be repaired and restored to their original conditions as soon as practical. The repaired area may be covered with a biodegradeable fabric or netting anchored to the soil with staples, or protected with some combination of repellants and fencing as determined by the WRSP wildlife specialist.

Temporary Stabilization: Plant cover protection from wildlife will be initiated as needed, on a site specific basis. Newly seeded areas will be covered with a biodegradeable fabric and anchored to the soil with staples and irrigated as necessary to maintain plant cover.

Processed Shale Area: Aspects of the vegetation protection, maintenance and repair of the processed shale area are detailed in section 4.6.2.5 of the DDP.

ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION AFTER MITIGATION

5.1 Processed Shale Disposal Area

The processed shale pile may impact a larger area during Phase I than originally shown in the DDP (approximately 160 acres) depending on how well the processed shale can be compacted. However, the entire processed shale disposal area for Phases I, II and III will not increase from that stated in the DDP. If additional area is impacted for Phase I disposal (up to 325 acres), a proportionate amount of habitat will be lost. The Phase I processed shale dam and lined pond will collect all runoff and leachate, regardless of the configuration of the Phase I pile. The entire pile will be reclaimed.

Form 1279-3
(June 1984)
BORROWER
=TN 859 .U82 W551 1982

White River Shale Proj
detailed development

DATE LOANED	BORROWER

USDI – BLM

ATTACHED DRAWINGS

SCH-00-PR-9	Rev. 2	Milestone Schedule for Construction (Sheet 1 of 2)
SCH-00-PR-10	Rev. 2	Milestone Schedule for Construction (Sheet 2 of 2)
D-00-CE-3	Rev. 2	Plot Plan Surface Mining Facilities
D-92-GA-5	Rev. 0	Underground Mining General Arrangement Shaft Area Plan & Section
E-92-GA-1	Rev. 0	Underground Mine General Arrangement Shaft Area - Isometric
E-817-UM-G1		Mine Design Layout
D-92-FS-1	Rev. 5	Underground Mining Facilities Crushing Flowsheet
D-18-GA-11	Rev. 2	Decline-Site Plan & G.A.
D-18-GA-12	Rev. 3	Decline-Upper Leg G.A. & Details
D-18-GA-13	Rev. 3	Decline-Transfer Station G.A.
D-18-GA-14	Rev. 3	Decline-Lower Leg G.A. & Details
D-18-SC-11	Rev. 3	Decline-Portal Plan & Sections
D-18-SC-12	Rev. 3	Decline-Portal Details
D-18-CE-11	Rev. 4	Decline-Vent Raise
D-18-CE-12	Rev. 3	Decline-Transfer Station Details
D-18-CE-13	Rev. 2	Decline-Bottom & Air Shaft Ramp
D-18-CE-14	Rev. 3	Decline-Crusher Discharge Area Ground Control
D-11-GA-11	Rev. 2	Air Intake Shaft-Plan & Section
D-11-GA-12	Rev. 2	Air Intake Shaft-Security Fence Arr.
D-11-SC-11	Rev. 3	Air Intake Shaft-Collar Concrete & Details
D-11-CE-11	Rev. 2	Air Intake Shaft-Details
D-11-CE-12	Rev. 2	Air Intake Shaft-Bottom Details
D-00-CE-4	Rev. 0	Title Sheet
D-00-CE-1	Rev. C	Overall Plot Plan
D-00-CE-6	Rev. A	Limits of Work - Mine Shaft Area
D-10-CE-2	Rev. 1	Rough Grading Plan
SKB-84-CE-1	Rev. A	Location of Well Borings
D-26-AR-1	Rev. 2	Service Buildings - Floor Plan and Sections